FIG. 1

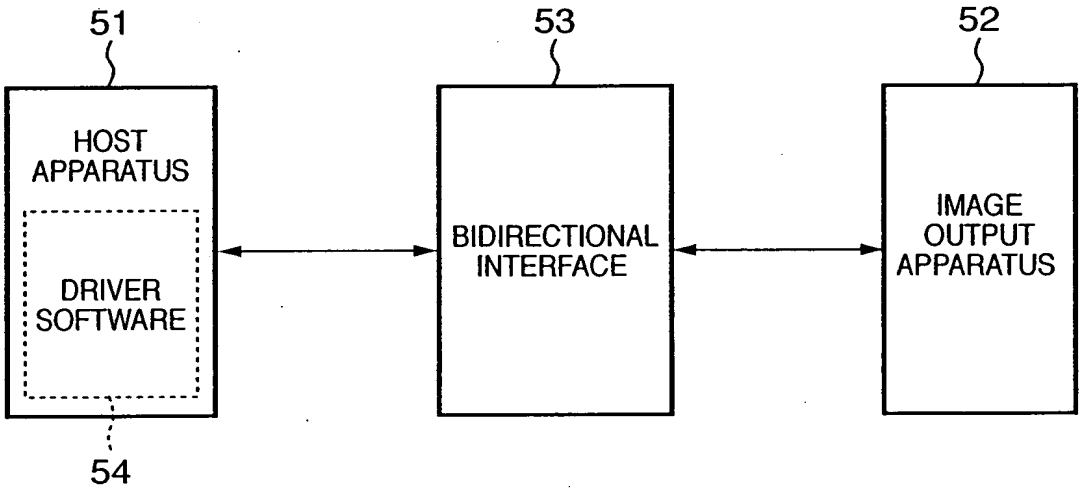


FIG. 2

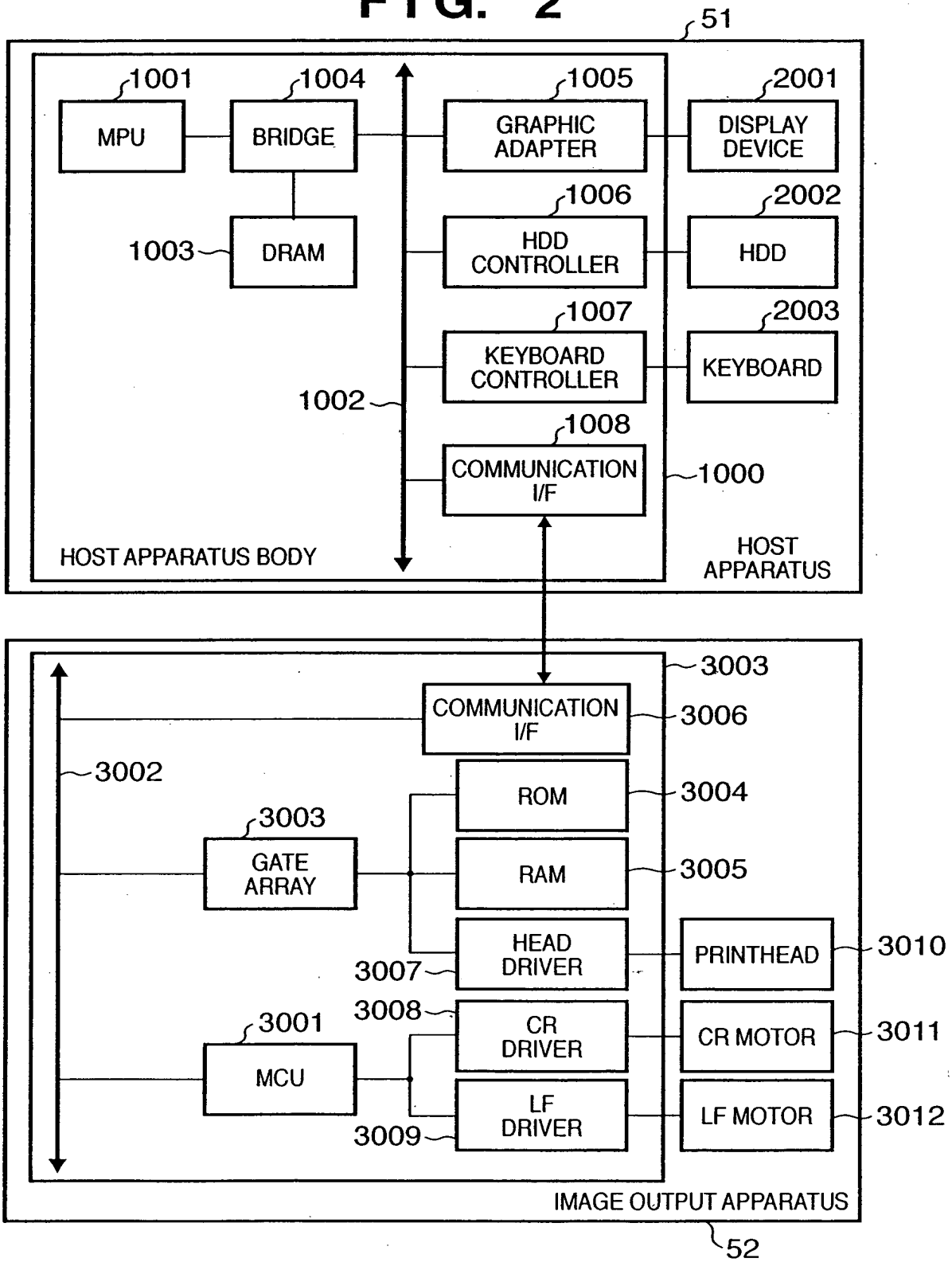

51
1001
MPU
1004
BRIDGE
1005
GRAPHIC ADAPTER
2001
DISPLAY DEVICE
1003
DRAM
1006
HDD CONTROLLER
2002
HDD
1007
KEYBOARD CONTROLLER
2003
KEYBOARD
1002
1008
COMMUNICATION I/F
1000
HOST APPARATUS BODY
HOST APPARATUS
3003
COMMUNICATION I/F
3006
3002
ROM
3004
3003
GATE ARRAY
RAM
3005
HEAD DRIVER
PRINTHEAD
3010
3007
3008
3001
CR DRIVER
CR MOTOR
3011
MCU
LF DRIVER
LF MOTOR
3012
3009
IMAGE OUTPUT APPARATUS
52

FIG. 3

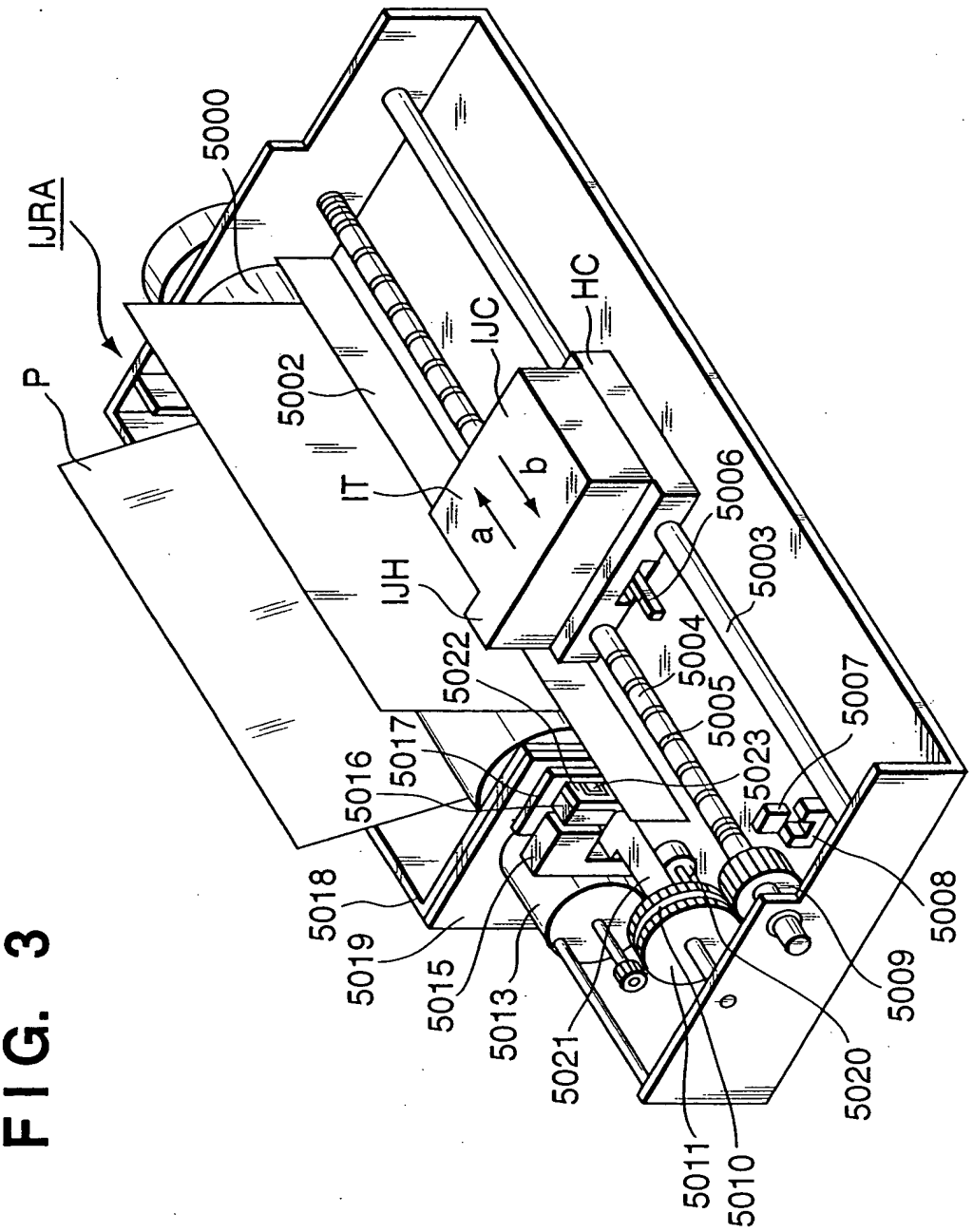

IJRA
5000
P
5002
IJC
HC
IT
a
b
IJH
5022
5006
5003
5004
5005
5007
5023
5017
5016
5018
5019
5015
5013
5021
5011
5010
5020
5009
5008

FIG. 4

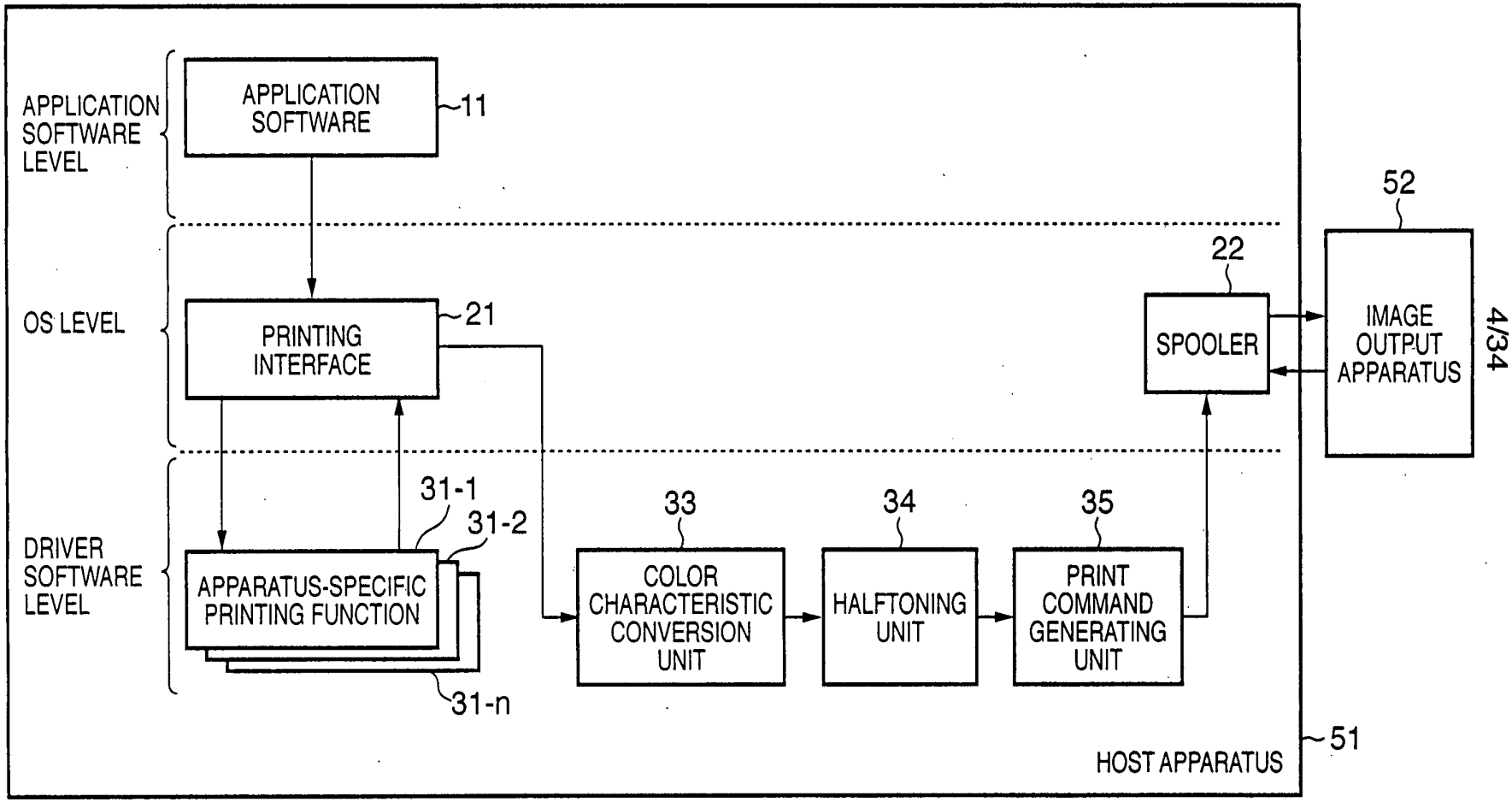

APPLICATION SOFTWARE LEVEL
APPLICATION SOFTWARE
11
OS LEVEL
PRINTING INTERFACE
21
DRIVER SOFTWARE LEVEL
31-1
31-2
APPARATUS-SPECIFIC PRINTING FUNCTION
31-n
33
COLOR CHARACTERISTIC CONVERSION UNIT
34
HALFTONING UNIT
35
PRINT COMMAND GENERATING UNIT
22
SPOOLER
52
IMAGE OUTPUT APPARATUS
HOST APPARATUS
51

FIG. 5

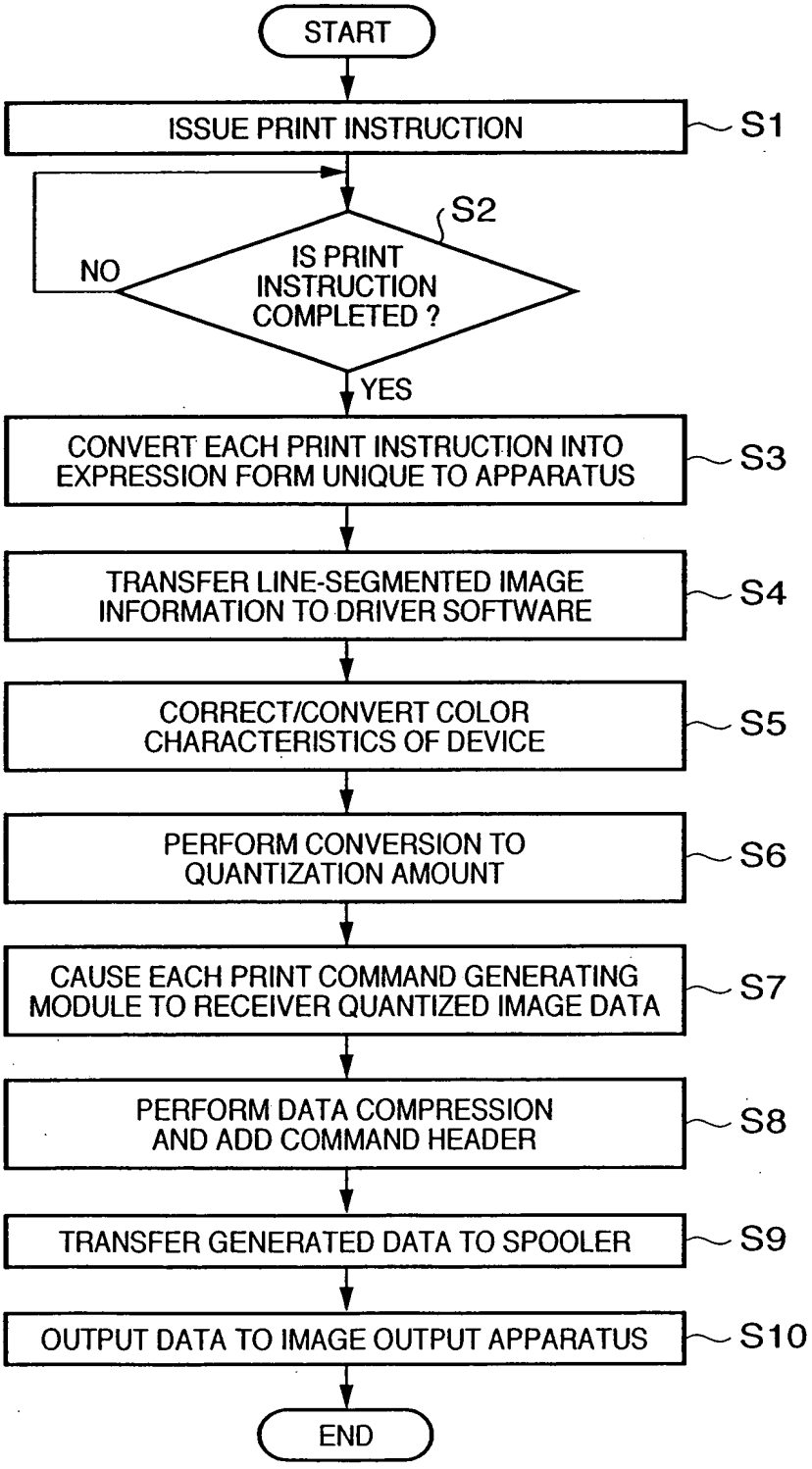

START
ISSUE PRINT INSTRUCTION
S1
S2
IS PRINT INSTRUCTION COMPLETED ?
NO
YES
CONVERT EACH PRINT INSTRUCTION INTO EXPRESSION FORM UNIQUE TO APPARATUS
S3
TRANSFER LINE-SEGMENTED IMAGE INFORMATION TO DRIVER SOFTWARE
S4
CORRECT/CONVERT COLOR CHARACTERISTICS OF DEVICE
S5
PERFORM CONVERSION TO QUANTIZATION AMOUNT
S6
CAUSE EACH PRINT COMMAND GENERATING MODULE TO RECEIVER QUANTIZED IMAGE DATA
S7
PERFORM DATA COMPRESSION AND ADD COMMAND HEADER
S8
TRANSFER GENERATED DATA TO SPOOLER
S9
OUTPUT DATA TO IMAGE OUTPUT APPARATUS
S10
END

FIG. 6

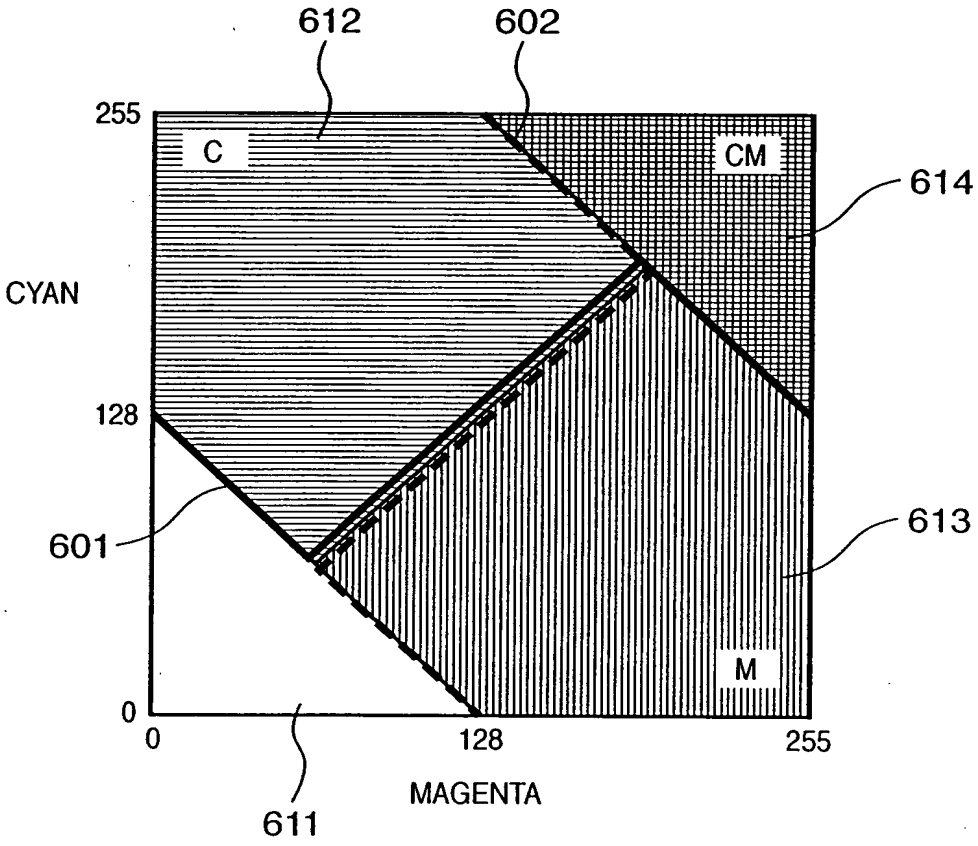


FIG. 7

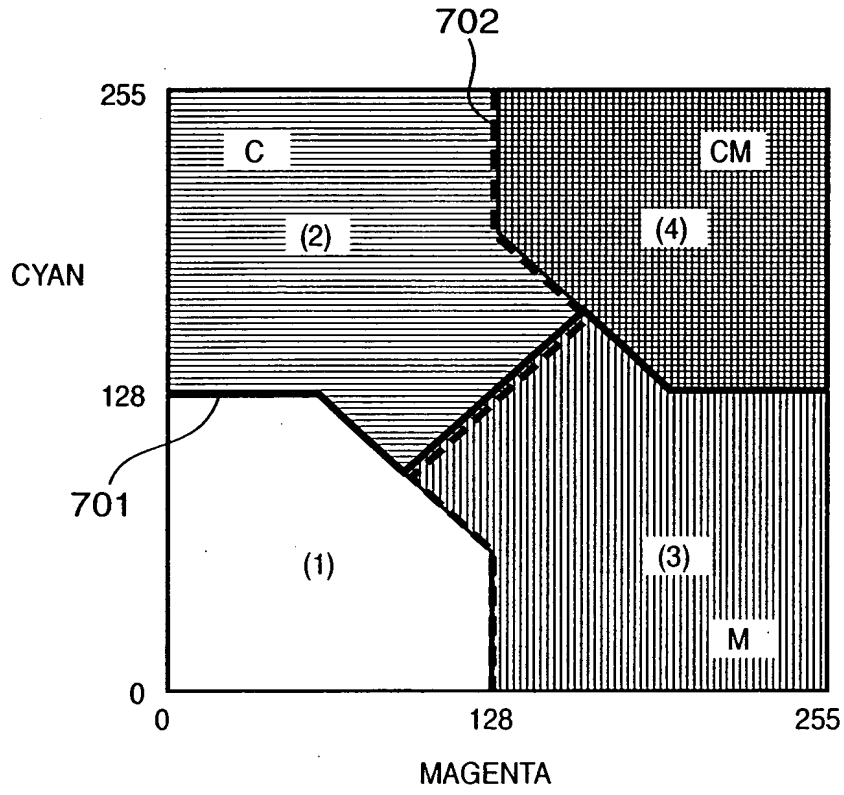


FIG. 8

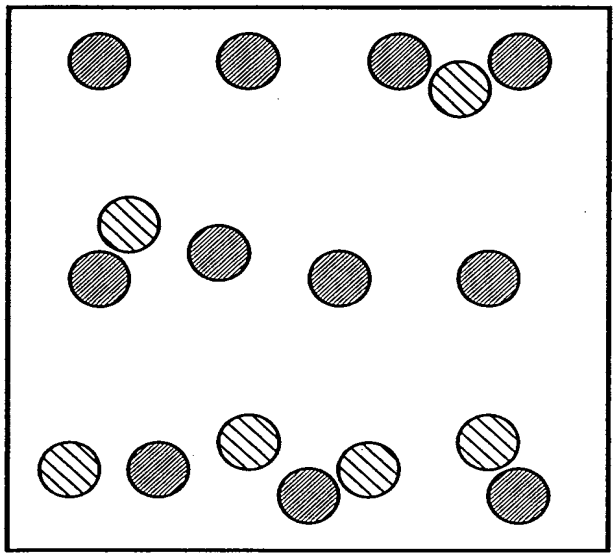


FIG. 9

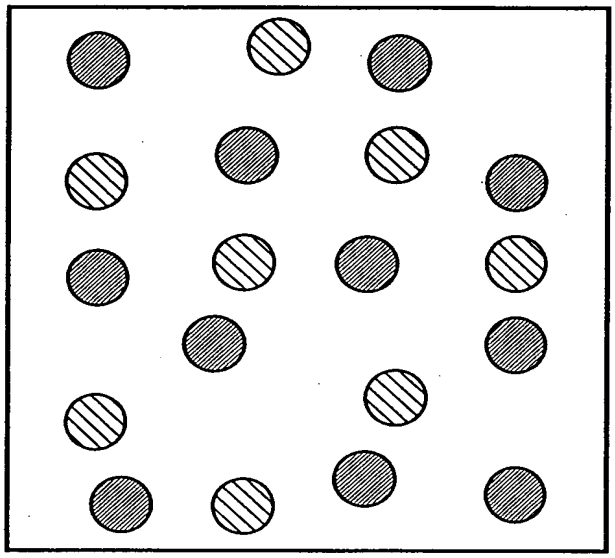


FIG. 10

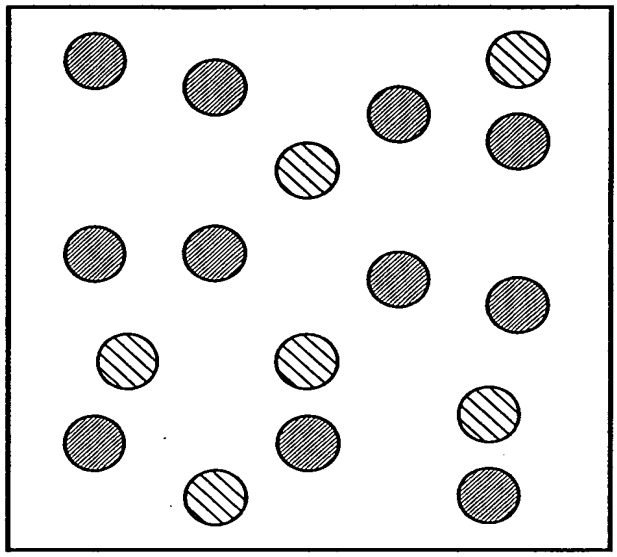


FIG. 11

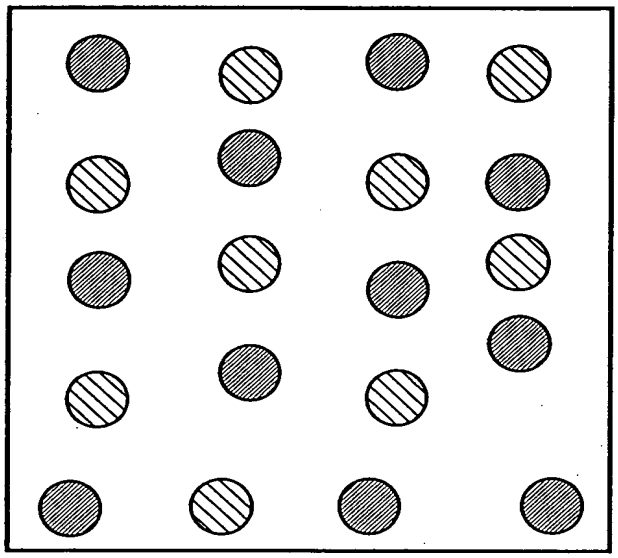
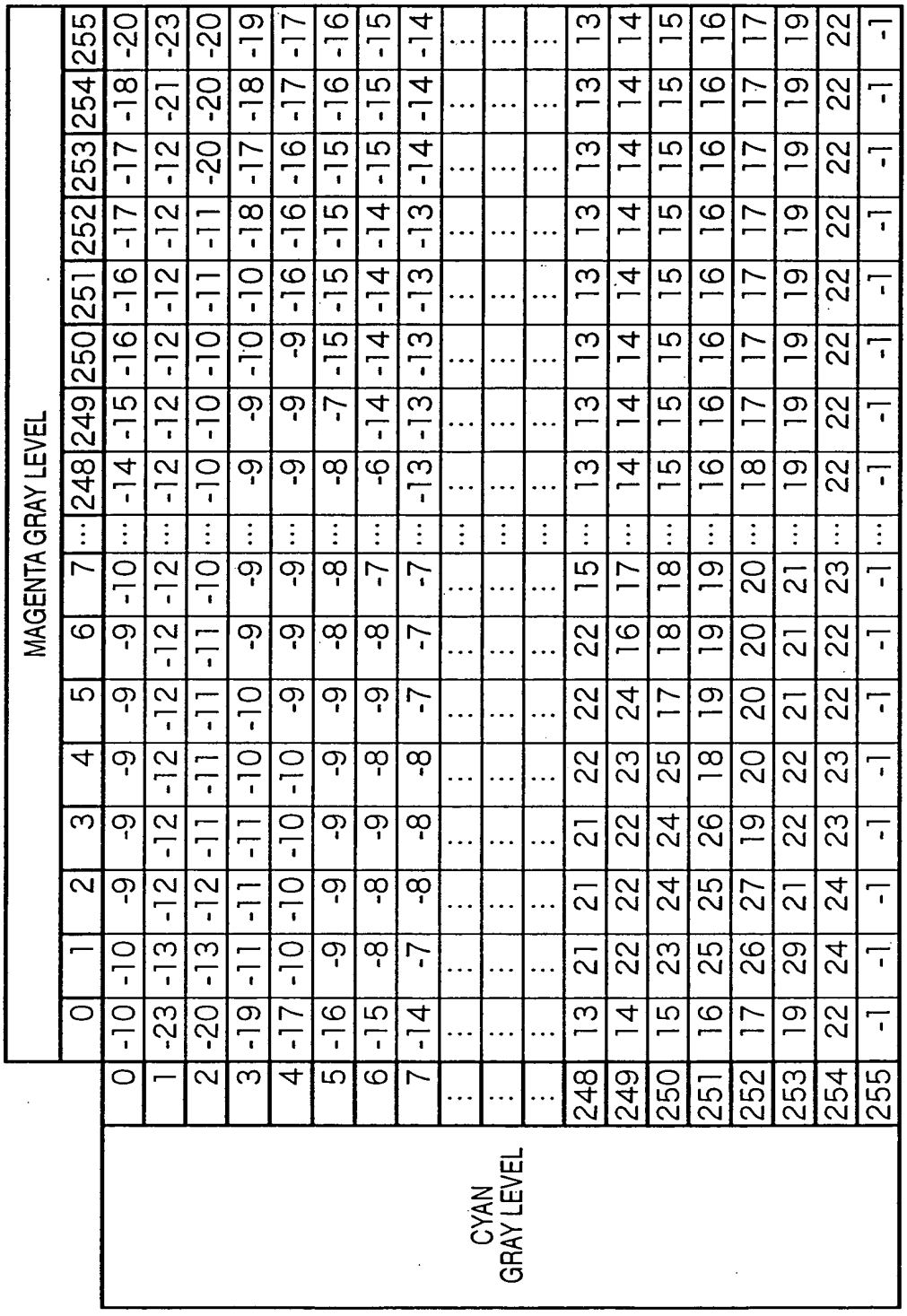


FIG. 12



CYAN GRAY LEVEL \ MAGENTA GRAY LEVEL	0	1	2	3	4	5	6	7	…	248	249	250	251	252	253	254	255
0	-10	-10	-9	-9	-9	-9	-9	-10	…	-14	-15	-16	-16	-17	-17	-18	-20
1	-23	-13	-12	-12	-12	-12	-12	-12	…	-12	-12	-12	-12	-12	-12	-21	-23
2	-20	-13	-12	-11	-11	-11	-11	-10	…	-10	-10	-10	-11	-11	-20	-20	-20
3	-19	-11	-11	-11	-10	-10	-9	-9	…	-9	-9	-10	-10	-18	-17	-18	-19
4	-17	-10	-10	-10	-10	-9	-9	-9	…	-9	-9	-9	-16	-16	-16	-17	-17
5	-16	-9	-9	-9	-9	-9	-8	-8	…	-8	-7	-15	-15	-15	-15	-16	-16
6	-15	-8	-8	-9	-8	-9	-8	-7	…	-6	-14	-14	-14	-14	-15	-15	-15
7	-14	-7	-8	-8	-8	-7	-7	-7	…	-13	-13	-13	-13	-13	-14	-14	-14
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
248	13	21	21	21	22	22	22	15	…	13	13	13	13	13	13	13	13
249	14	22	22	22	23	24	16	17	…	14	14	14	14	14	14	14	14
250	15	23	24	24	25	17	18	18	…	15	15	15	15	15	15	15	15
251	16	25	25	26	18	19	19	19	…	16	16	16	16	16	16	16	16
252	17	26	27	19	20	20	20	20	…	18	17	17	17	17	17	17	17
253	19	29	21	22	22	21	21	21	…	19	19	19	19	19	19	19	19
254	22	24	24	23	23	22	22	23	…	22	22	22	22	22	22	22	22
255	-1	-1	-1	-1	-1	-1	-1	-1	…	-1	-1	-1	-1	-1	-1	-1	-1

FIG. 13

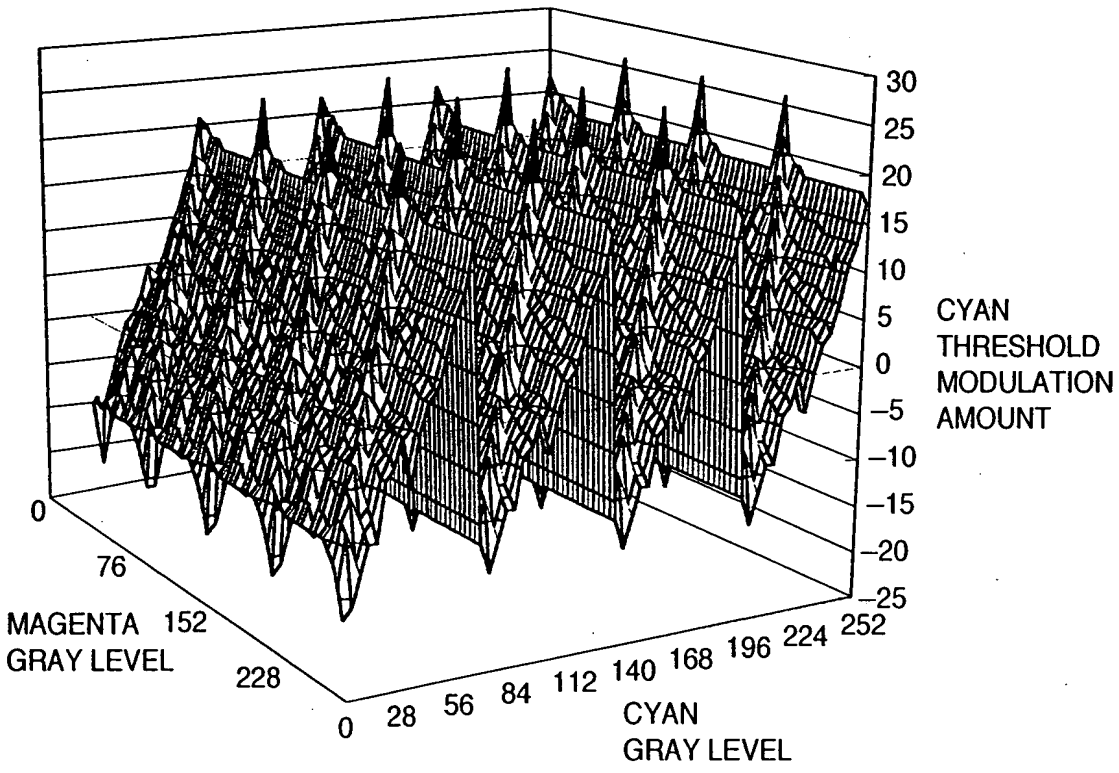
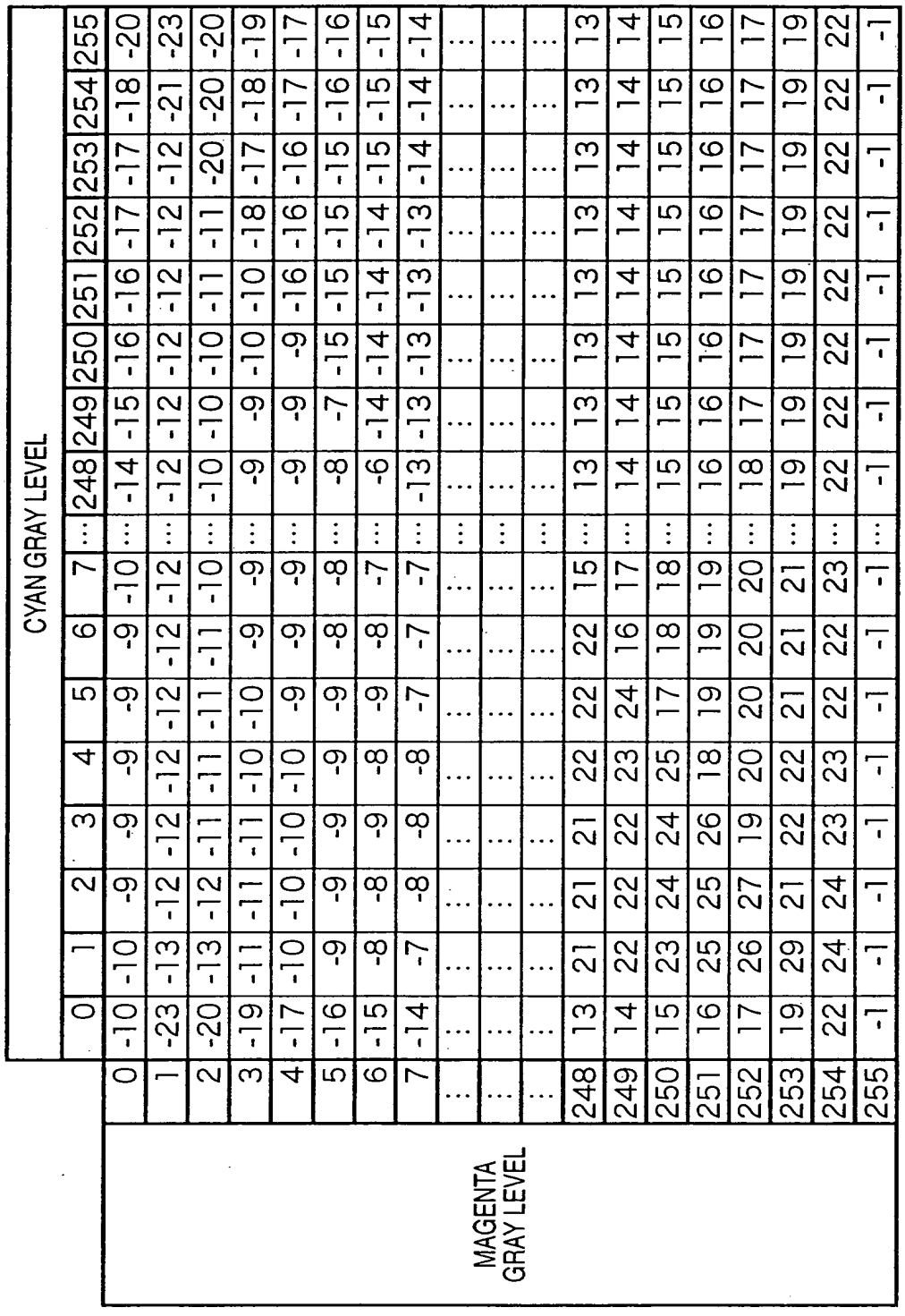

30
25
20
15
10
5
0
−5
−10
−15
−20
−25
CYAN
THRESHOLD
MODULATION
AMOUNT
0
76
152
228
MAGENTA
GRAY LEVEL
0
28
56
84
112
140
168
196
224
252
CYAN
GRAY LEVEL

FIG. 14



MAGENTA GRAY LEVEL \ CYAN GRAY LEVEL	0	1	2	3	4	5	6	7	…	248	249	250	251	252	253	254	255
0	-10	-10	-9	-9	-9	-9	-9	-10	…	-14	-15	-16	-16	-17	-17	-18	-20
1	-23	-13	-12	-12	-12	-12	-12	-12	…	-12	-12	-12	-12	-12	-12	-21	-23
2	-20	-13	-12	-11	-11	-11	-11	-10	…	-10	-10	-10	-11	-11	-20	-20	-20
3	-19	-11	-11	-11	-10	-10	-9	-9	…	-9	-9	-10	-10	-18	-17	-18	-19
4	-17	-10	-10	-10	-10	-9	-9	-9	…	-9	-9	-9	-16	-16	-16	-17	-17
5	-16	-9	-9	-9	-9	-9	-8	-8	…	-8	-7	-15	-15	-15	-15	-16	-16
6	-15	-8	-8	-9	-8	-9	-8	-7	…	-6	-14	-14	-14	-14	-15	-15	-15
7	-14	-7	-8	-8	-8	-7	-7	-7	…	-13	-13	-13	-13	-13	-14	-14	-14
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
248	13	21	21	21	22	22	22	15	…	13	13	13	13	13	13	13	13
249	14	22	22	22	23	24	16	17	…	14	14	14	14	14	14	14	14
250	15	23	24	24	25	17	18	18	…	15	15	15	15	15	15	15	15
251	16	25	25	26	18	19	19	19	…	16	16	16	16	16	16	16	16
252	17	26	27	19	20	20	20	20	…	18	17	17	17	17	17	17	17
253	19	29	21	22	22	21	21	21	…	19	19	19	19	19	19	19	19
254	22	24	24	23	23	22	22	23	…	22	22	22	22	22	22	22	22
255	-1	-1	-1	-1	-1	-1	-1	-1	…	-1	-1	-1	-1	-1	-1	-1	-1

FIG. 15

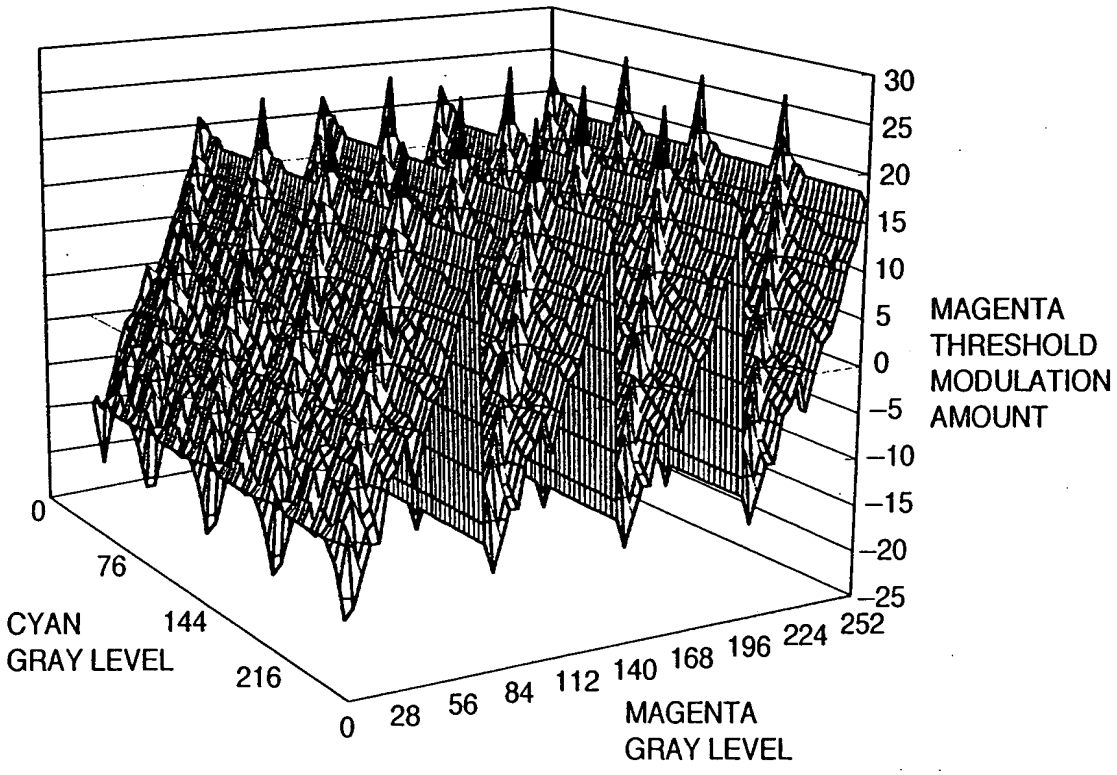
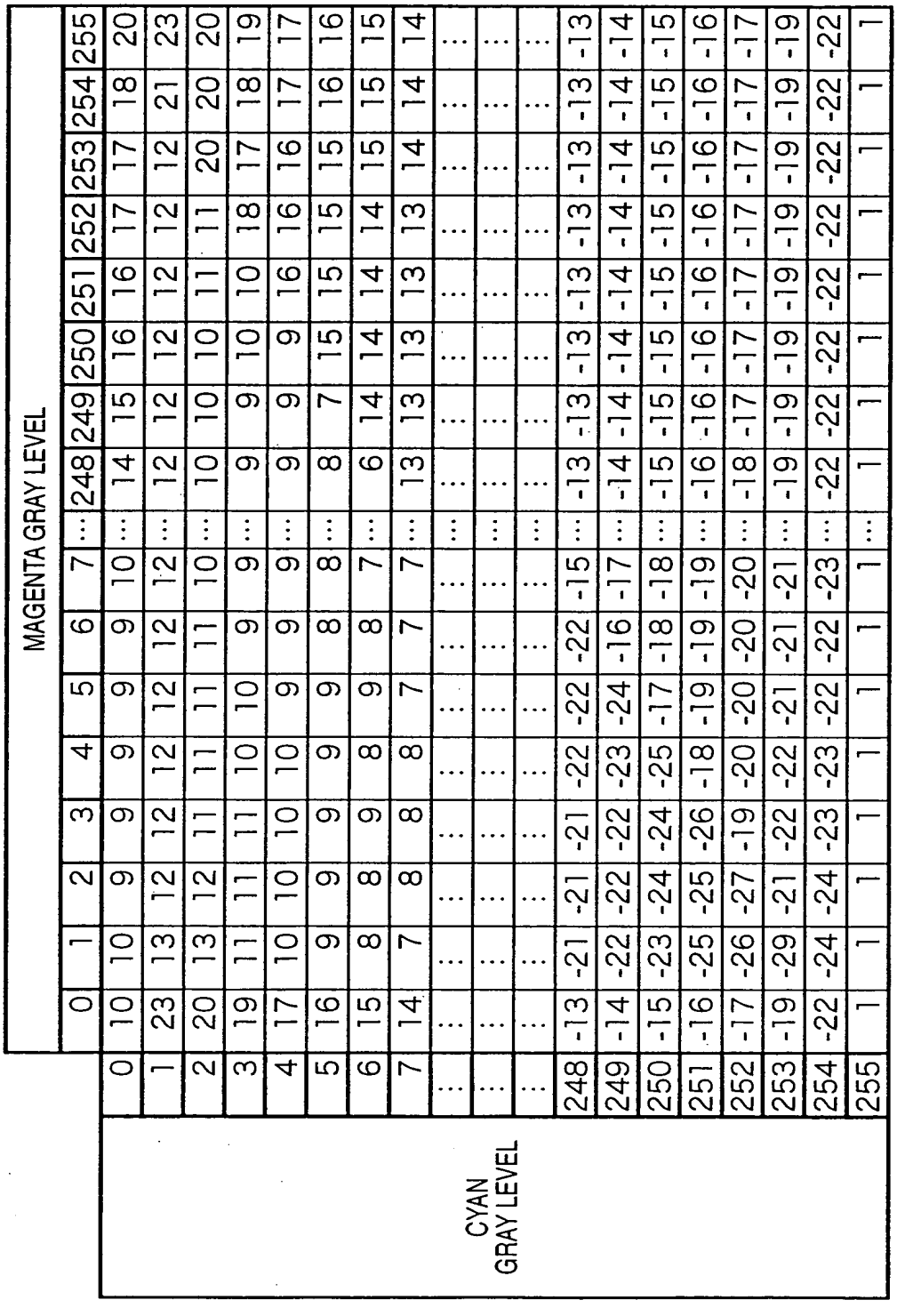

30
25
20
15
10
5
0
−5
−10
−15
−20
−25
MAGENTA
THRESHOLD
MODULATION
AMOUNT
0
76
144
216
CYAN
GRAY LEVEL
0
28
56
84
112
140
168
196
224
252
MAGENTA
GRAY LEVEL

FIG. 16



CYAN GRAY LEVEL \ MAGENTA GRAY LEVEL	0	1	2	3	4	5	6	7	…	248	249	250	251	252	253	254	255
0	10	10	9	9	9	9	9	10	…	14	15	16	16	17	17	18	20
1	23	13	12	12	12	12	12	12	…	12	12	12	12	12	12	21	23
2	20	13	12	11	11	11	11	10	…	10	10	10	11	11	20	20	20
3	19	11	11	11	10	10	9	9	…	9	9	10	10	18	17	18	19
4	17	10	10	10	10	9	9	9	…	9	9	9	16	16	16	17	17
5	16	9	9	9	9	9	8	8	…	8	7	15	15	15	15	16	16
6	15	8	8	9	8	9	8	7	…	6	14	14	14	14	15	15	15
7	14	7	8	8	8	7	7	7	…	13	13	13	13	13	14	14	14
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
248	-13	-21	-21	-21	-22	-22	-22	-15	…	-13	-13	-13	-13	-13	-13	-13	-13
249	-14	-22	-22	-22	-23	-24	-16	-17	…	-14	-14	-14	-14	-14	-14	-14	-14
250	-15	-23	-24	-24	-25	-17	-18	-18	…	-15	-15	-15	-15	-15	-15	-15	-15
251	-16	-25	-25	-26	-18	-19	-19	-19	…	-16	-16	-16	-16	-16	-16	-16	-16
252	-17	-26	-27	-19	-20	-20	-20	-20	…	-18	-17	-17	-17	-17	-17	-17	-17
253	-19	-29	-21	-22	-22	-21	-21	-21	…	-19	-19	-19	-19	-19	-19	-19	-19
254	-22	-24	-24	-23	-23	-22	-22	-23	…	-22	-22	-22	-22	-22	-22	-22	-22
255	1	1	1	1	1	1	1	1	…	1	1	1	1	1	1	1	1

FIG. 17

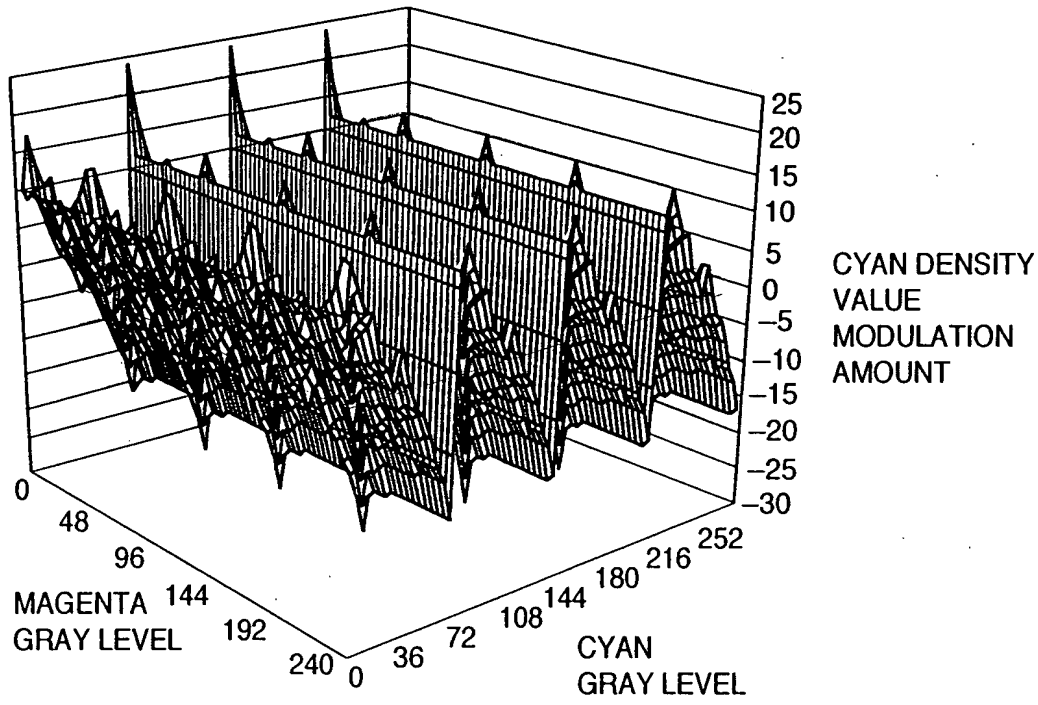
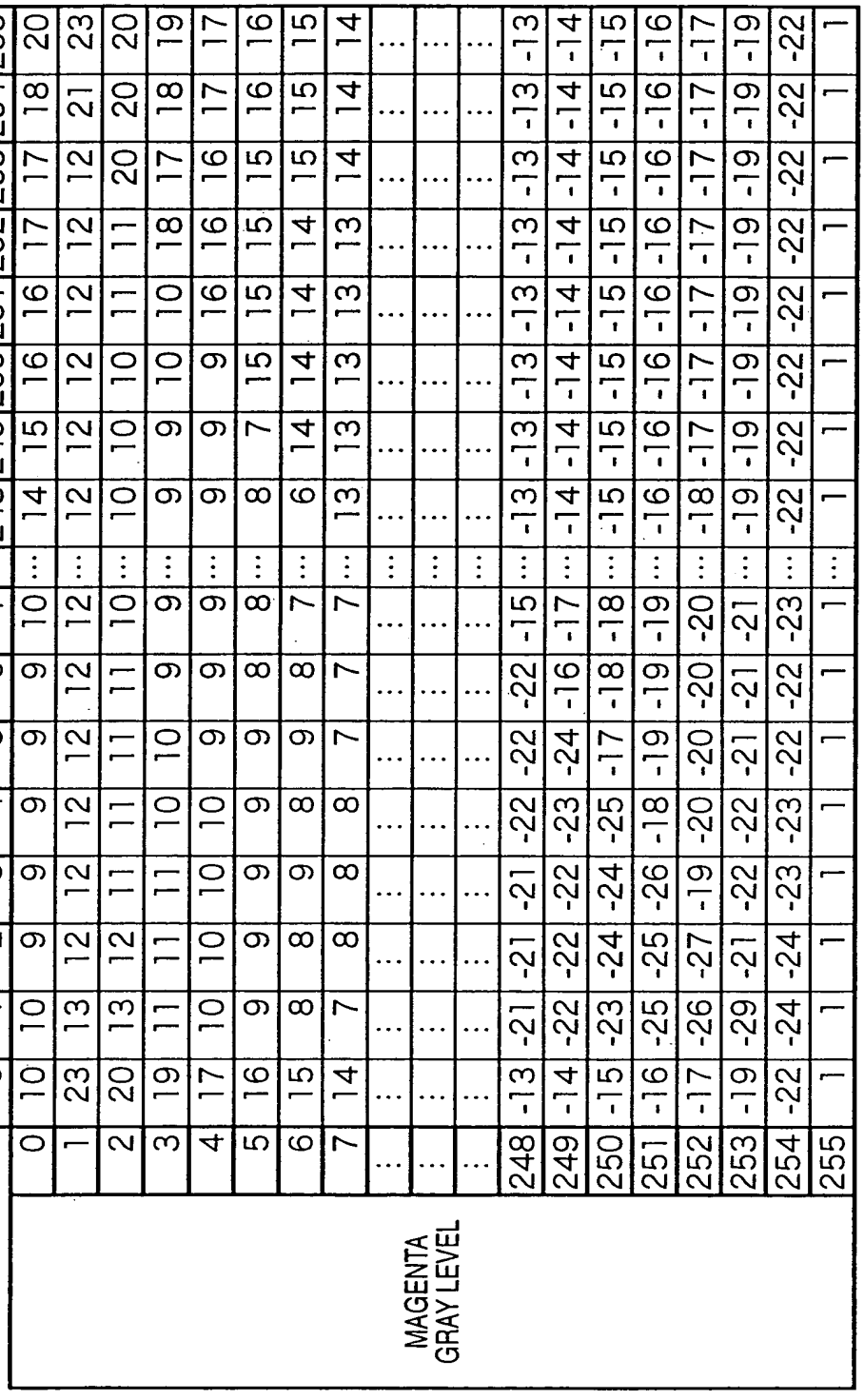

25
20
15
10
5
0
−5
−10
−15
−20
−25
−30
CYAN DENSITY VALUE MODULATION AMOUNT
0
48
96
144
192
240
MAGENTA GRAY LEVEL
0
36
72
108
144
180
216
252
CYAN GRAY LEVEL

FIG. 18



MAGENTA GRAY LEVEL \ CYAN GRAY LEVEL	0	1	2	3	4	5	6	7	...	248	249	250	251	252	253	254	255
0	10	10	9	9	9	9	9	10	...	14	15	16	16	17	17	18	20
1	23	13	12	12	12	12	12	12	...	12	12	12	12	12	12	21	23
2	20	13	12	11	11	11	11	10	...	10	10	10	11	11	20	20	20
3	19	11	11	11	10	10	9	9	...	9	9	10	10	18	17	18	19
4	17	10	10	10	10	9	9	9	...	9	9	9	16	16	16	17	17
5	16	9	9	9	9	9	8	8	...	8	7	15	15	15	15	16	16
6	15	8	8	9	8	9	8	7	...	6	14	14	14	14	15	15	15
7	14	7	8	8	8	7	7	7	...	13	13	13	13	13	14	14	14
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
248	-13	-21	-21	-21	-22	-22	-22	-15	...	-13	-13	-13	-13	-13	-13	-13	-13
249	-14	-22	-22	-22	-23	-24	-16	-17	...	-14	-14	-14	-14	-14	-14	-14	-14
250	-15	-23	-24	-24	-25	-17	-18	-18	...	-15	-15	-15	-15	-15	-15	-15	-15
251	-16	-25	-25	-26	-18	-19	-19	-19	...	-16	-16	-16	-16	-16	-16	-16	-16
252	-17	-26	-27	-19	-20	-20	-20	-20	...	-18	-17	-17	-17	-17	-17	-17	-17
253	-19	-29	-21	-22	-22	-21	-21	-21	...	-19	-19	-19	-19	-19	-19	-19	-19
254	-22	-24	-24	-23	-23	-22	-22	-23	...	-22	-22	-22	-22	-22	-22	-22	-22
255	1	1	1	1	1	1	1	1	...	1	1	1	1	1	1	1	1

FIG. 19

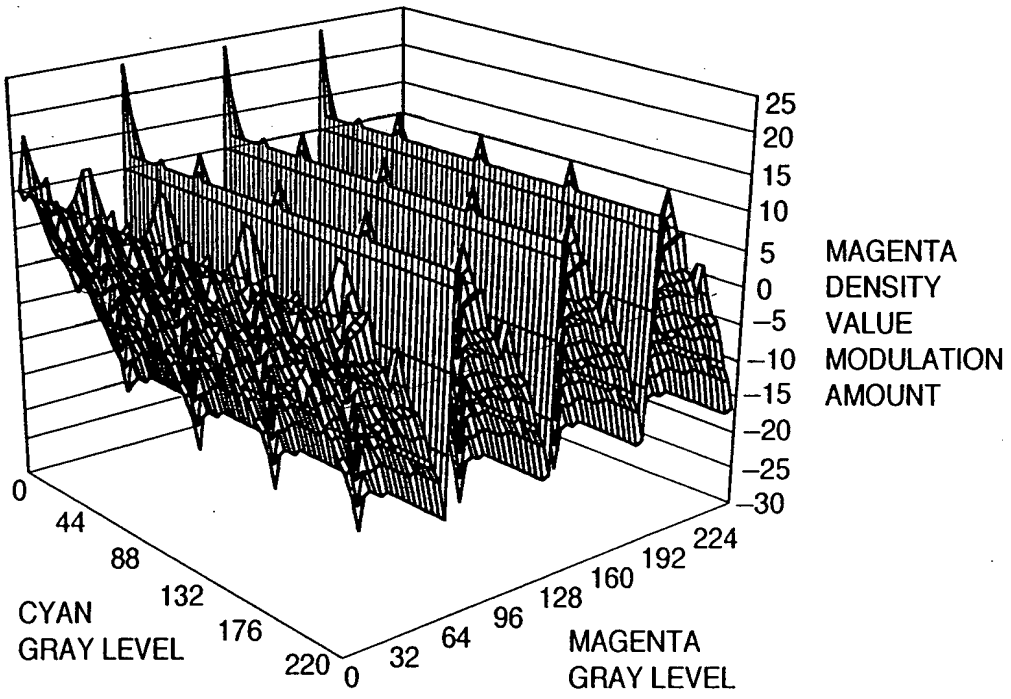

25
20
15
10
5
0
−5
−10
−15
−20
−25
−30
MAGENTA
DENSITY
VALUE
MODULATION
AMOUNT
0
44
88
132
176
220
CYAN
GRAY LEVEL
0
32
64
96
128
160
192
224
MAGENTA
GRAY LEVEL

FIG. 20

		MAGENTA GRAY LEVEL							
		0	2	4	6	8	10	12	14
CYAN GRAY LEVEL	0	(9,0,7,0)	(9,0,7,0)	(7,3,3,3)	(8,1,5,2)	(5,1,2,8)	(3,1,2,10)	(4,0,3,9)	(4,1,3,8)
	2	(9,0,7,0)	(9,2,2,3)	(9,2,3,2)	(9,1,4,2)	(9,4,1,2)	(8,0,6,2)	(7,2,3,4)	(7,1,4,4)
	4	(7,3,3,3)	(8,0,2,6)	(8,2,3,3)	(8,3,1,4)	(7,2,1,6)	(7,0,7,2)	(7,1,4,4)	(8,2,3,3)
	6	(8,1,5,2)	(9,0,6,1)	(7,0,5,4)	(8,1,1,6)	(8,2,3,3)	(6,1,3,6)	(7,1,3,5)	(6,1,1,8)
	8	(5,1,2,8)	(8,0,6,2)	(7,0,5,4)	(7,0,6,3)	(7,1,5,3)	(6,2,1,7)	(6,1,3,6)	(6,2,2,6)
	10	(3,1,2,10)	(8,0,6,2)	(7,2,0,7)	(6,1,1,8)	(5,0,2,9)	(7,1,2,6)	(6,0,2,8)	(5,1,2,8)
	12	(4,0,3,9)	(8,2,0,6)	(7,2,0,7)	(6,1,1,8)	(5,1,1,9)	(4,1,2,9)	(3,1,1,11)	(6,1,5,4)
	14	(4,1,3,8)	(9,1,2,4)	(7,2,0,7)	(6,2,0,8)	(5,0,3,8)	(4,1,2,9)	(4,0,3,9)	(3,0,7,6)

FIG. 21

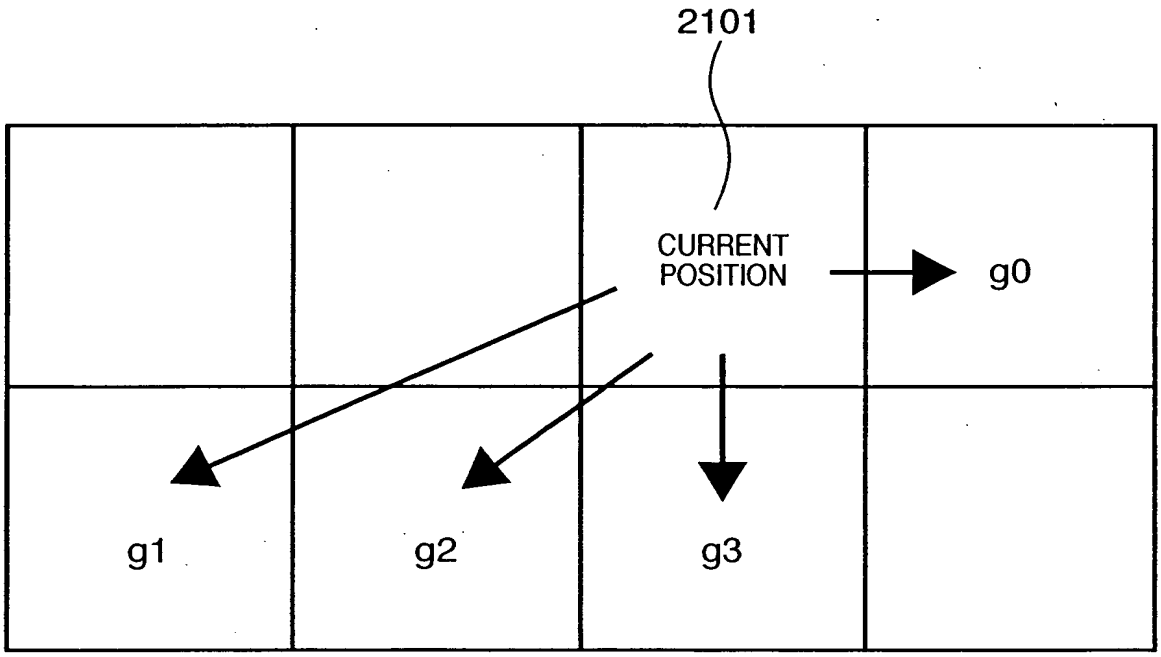


FIG. 22

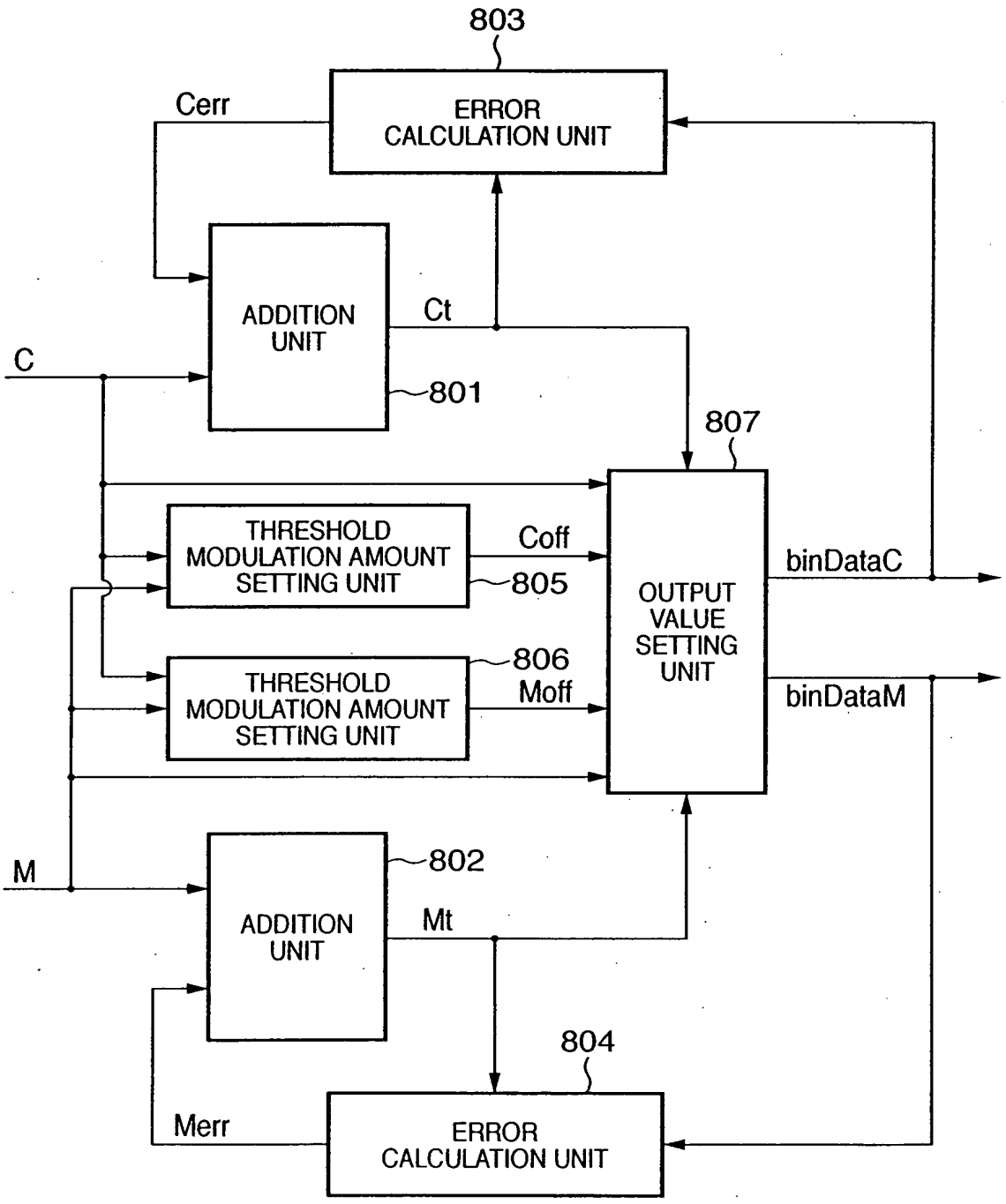

803
Cerr
ERROR CALCULATION UNIT
ADDITION UNIT
Ct
C
801
807
THRESHOLD MODULATION AMOUNT SETTING UNIT
Coff
805
binDataC
OUTPUT VALUE SETTING UNIT
806
THRESHOLD MODULATION AMOUNT SETTING UNIT
Moff
binDataM
M
802
ADDITION UNIT
Mt
804
Merr
ERROR CALCULATION UNIT

FIG. 23

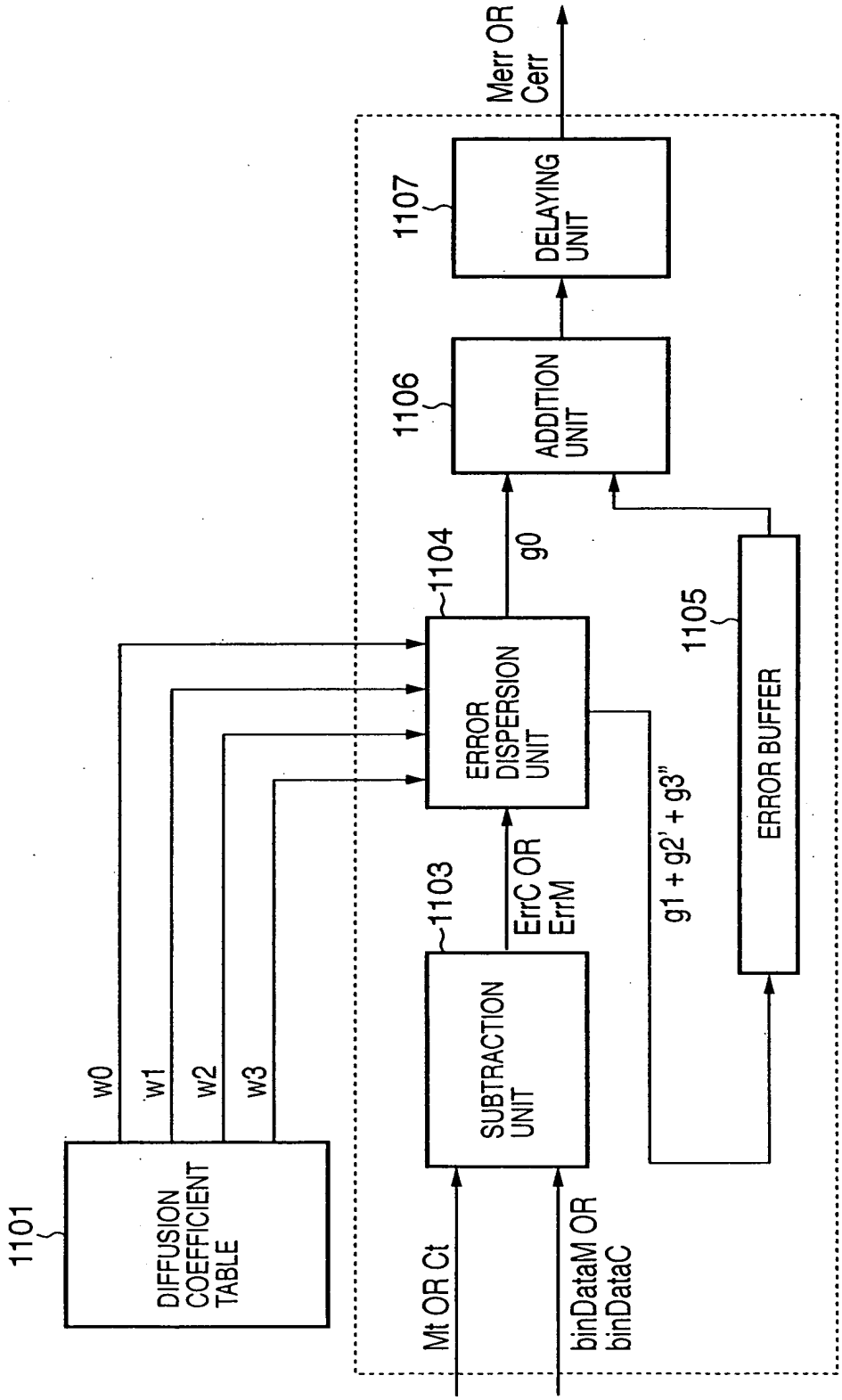

1101
DIFFUSION COEFFICIENT TABLE
w0
w1
w2
w3
1103
SUBTRACTION UNIT
ErrC OR ErrM
1104
ERROR DISPERSION UNIT
g0
1106
ADDITION UNIT
1107
DELAYING UNIT
Merr OR Cerr
1105
ERROR BUFFER
g1 + g2' + g3"
Mt OR Ct
binDataM OR binDataC

FIG. 24

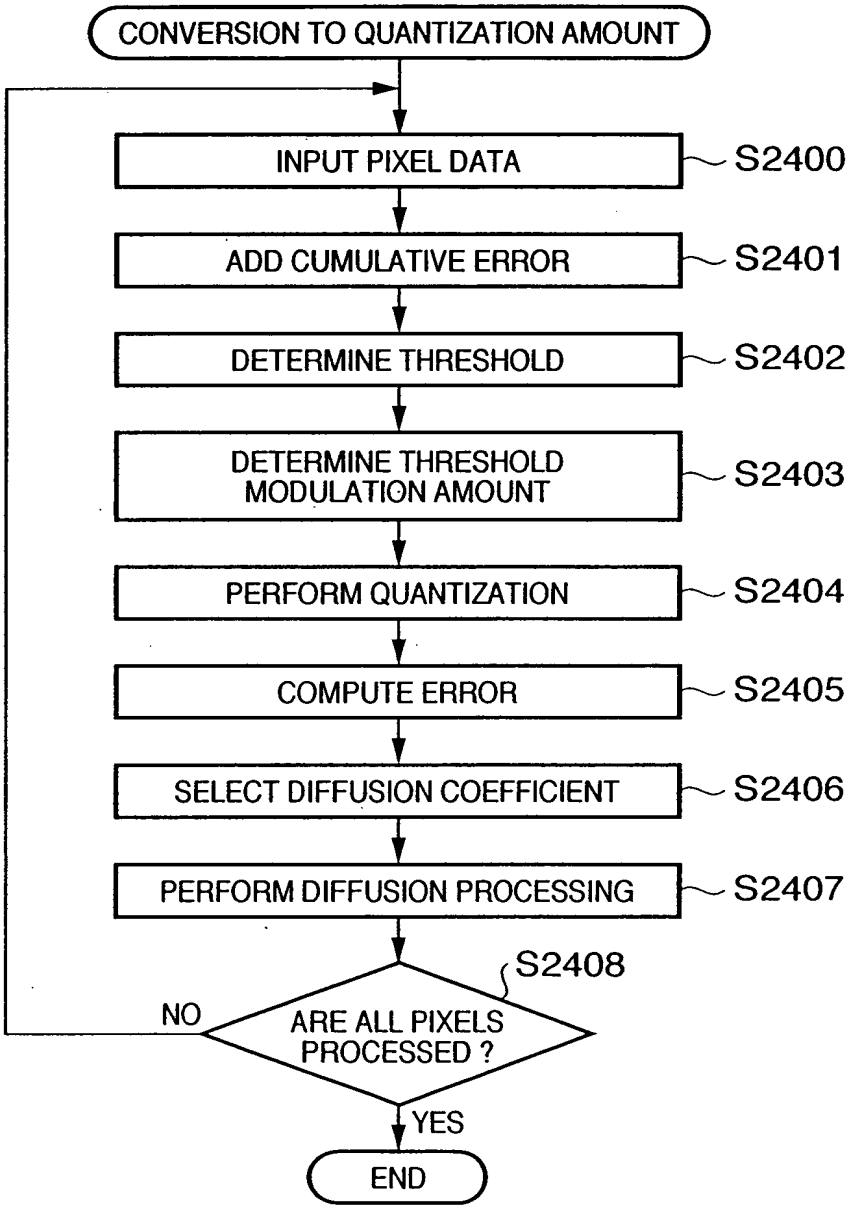

CONVERSION TO QUANTIZATION AMOUNT
INPUT PIXEL DATA
S2400
ADD CUMULATIVE ERROR
S2401
DETERMINE THRESHOLD
S2402
DETERMINE THRESHOLD MODULATION AMOUNT
S2403
PERFORM QUANTIZATION
S2404
COMPUTE ERROR
S2405
SELECT DIFFUSION COEFFICIENT
S2406
PERFORM DIFFUSION PROCESSING
S2407
S2408
ARE ALL PIXELS PROCESSED ?
NO
YES
END

FIG. 25

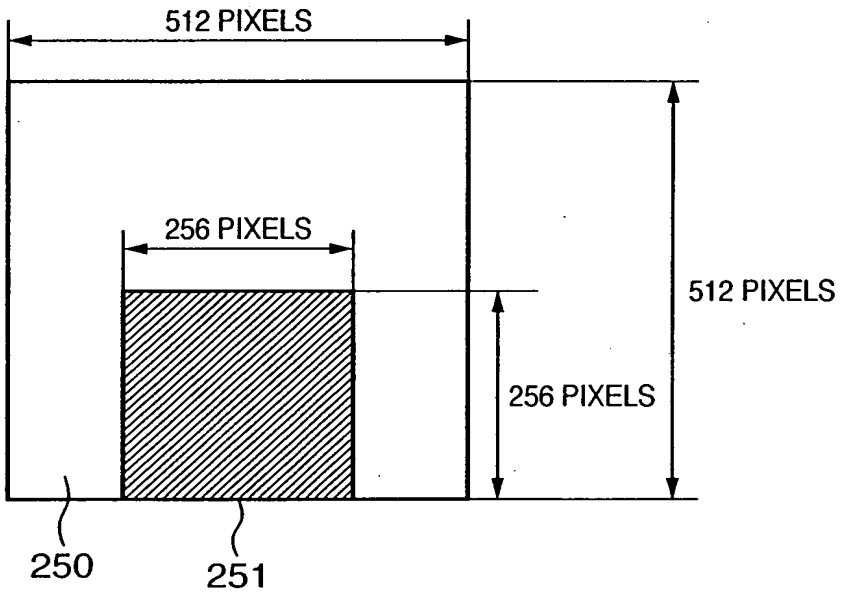


FIG. 26

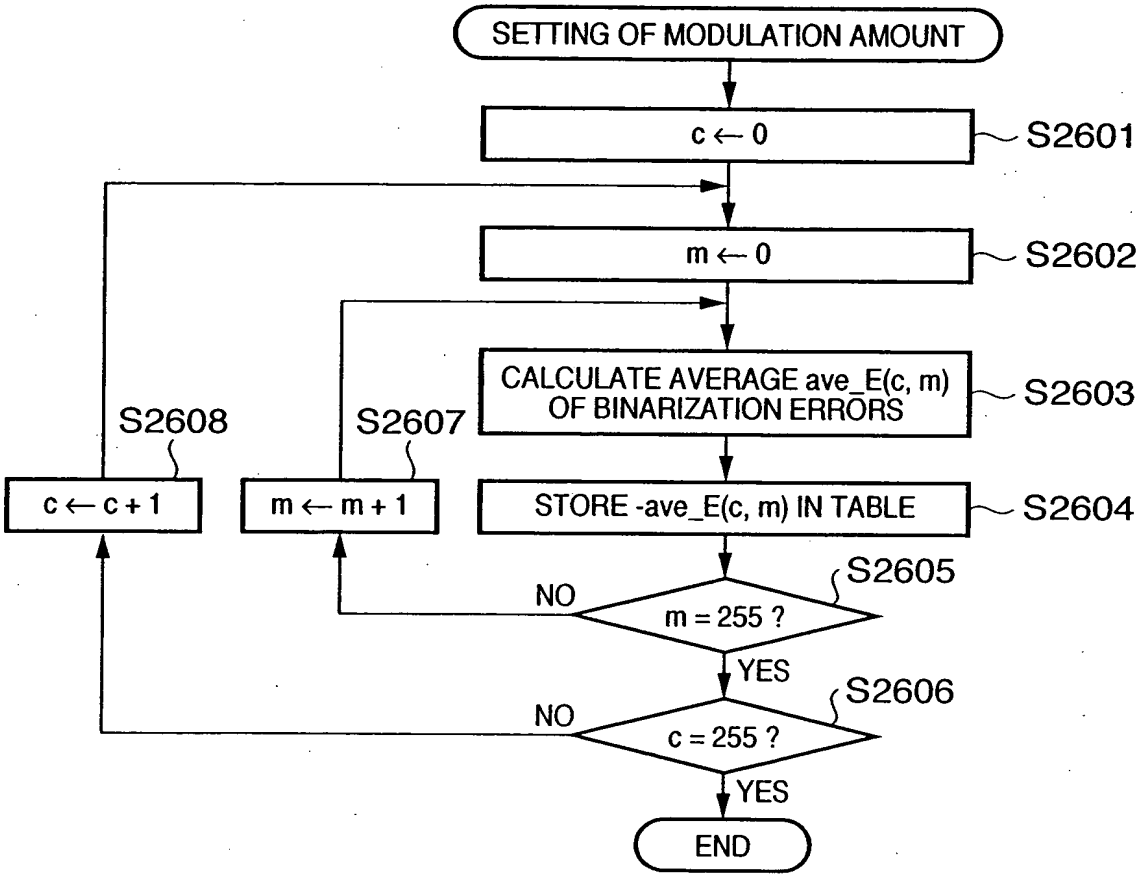

SETTING OF MODULATION AMOUNT
c ← 0
S2601
m ← 0
S2602
CALCULATE AVERAGE ave_E(c, m) OF BINARIZATION ERRORS
S2603
STORE -ave_E(c, m) IN TABLE
S2604
S2605
m = 255 ?
NO
YES
S2606
c = 255 ?
NO
YES
END
S2607
m ← m + 1
S2608
c ← c + 1

FIG. 27

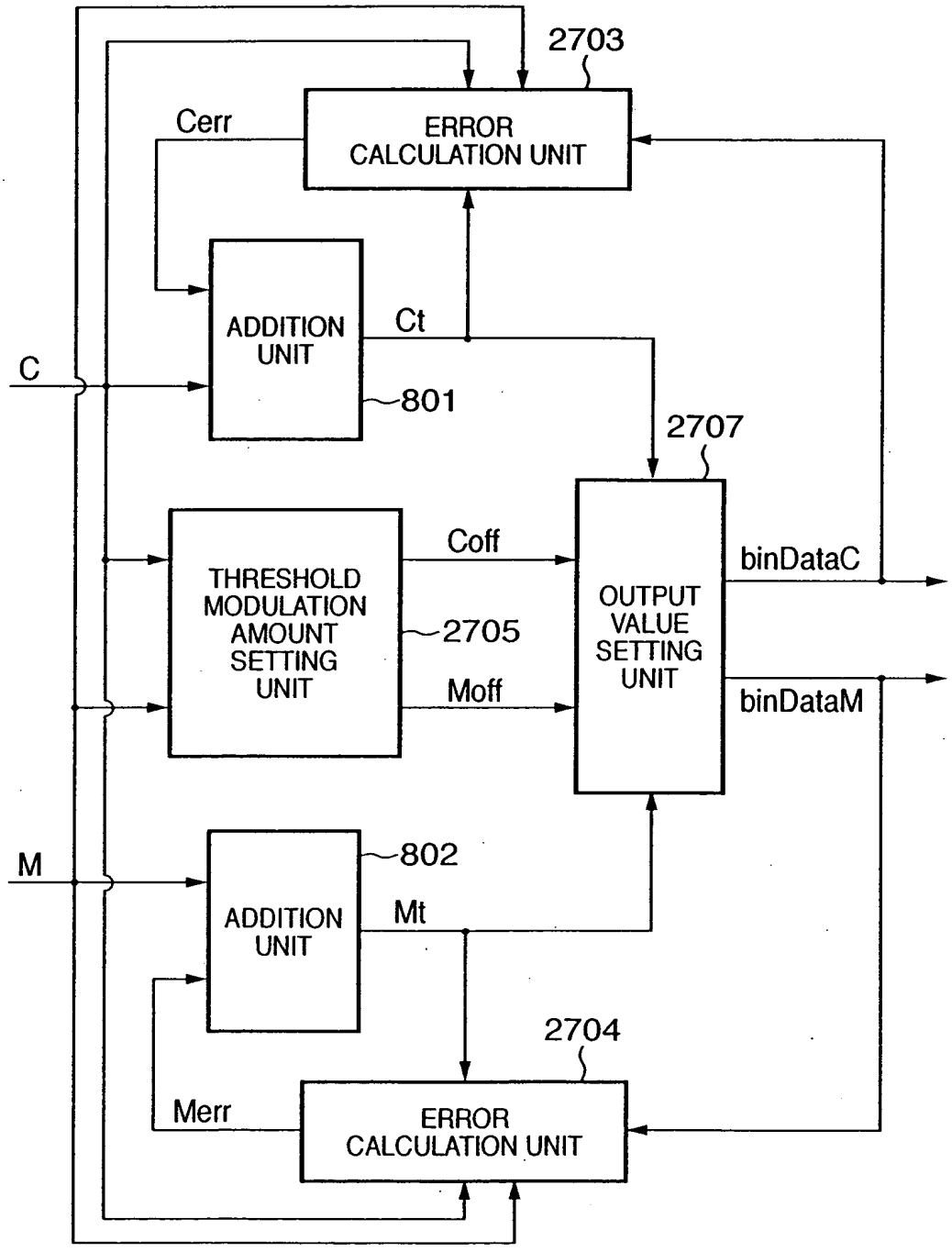

2703
Cerr
ERROR CALCULATION UNIT
ADDITION UNIT
Ct
C
801
2707
THRESHOLD MODULATION AMOUNT SETTING UNIT
Coff
2705
Moff
OUTPUT VALUE SETTING UNIT
binDataC
binDataM
M
802
ADDITION UNIT
Mt
2704
Merr
ERROR CALCULATION UNIT

FIG. 28

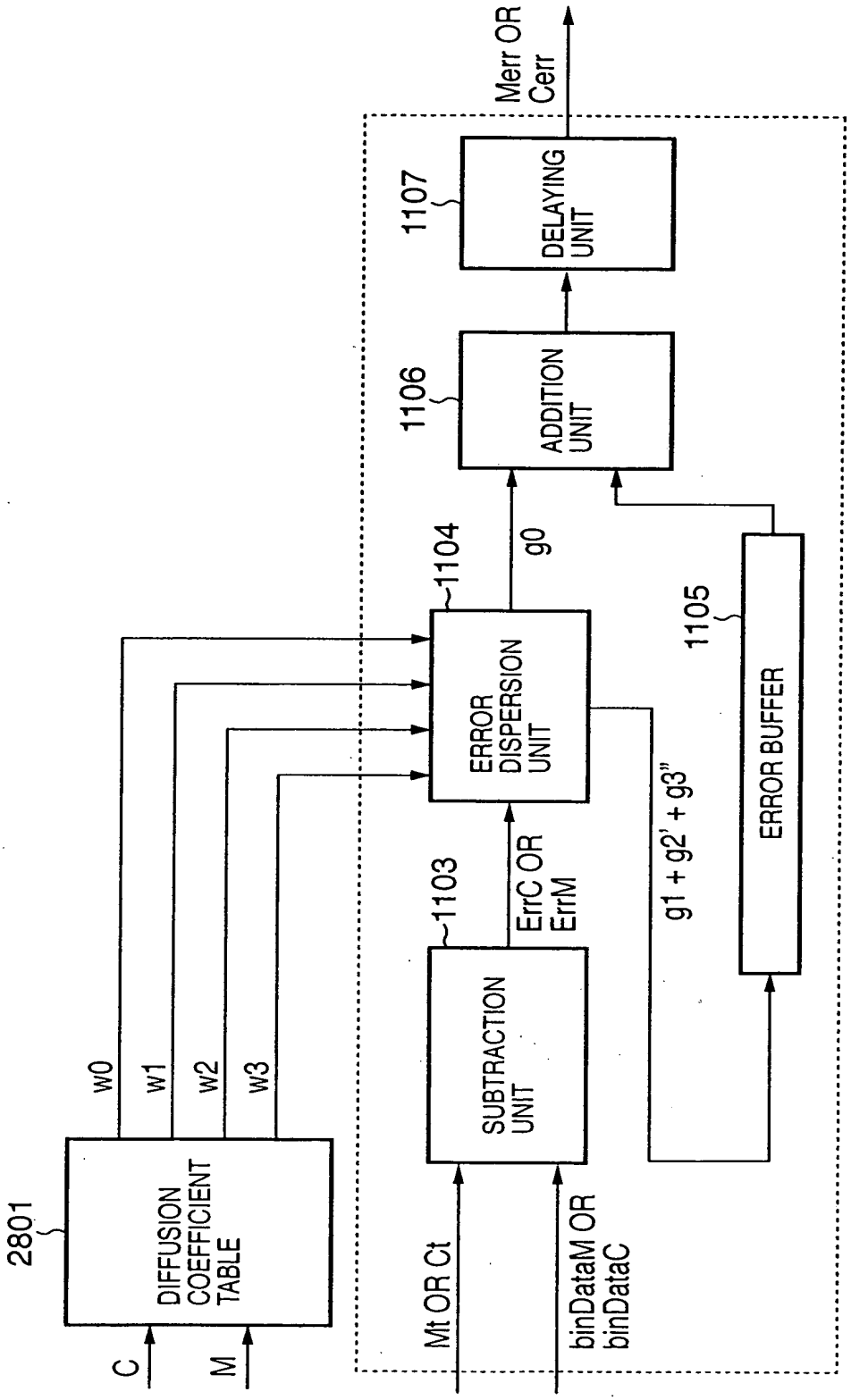

2801
DIFFUSION COEFFICIENT TABLE
C
M
w0
w1
w2
w3
1103
SUBTRACTION UNIT
Mt OR Ct
binDataM OR binDataC
ErrC OR ErrM
1104
ERROR DISPERSION UNIT
g0
g1 + g2' + g3"
1105
ERROR BUFFER
1106
ADDITION UNIT
1107
DELAYING UNIT
Merr OR Cerr

FIG. 29

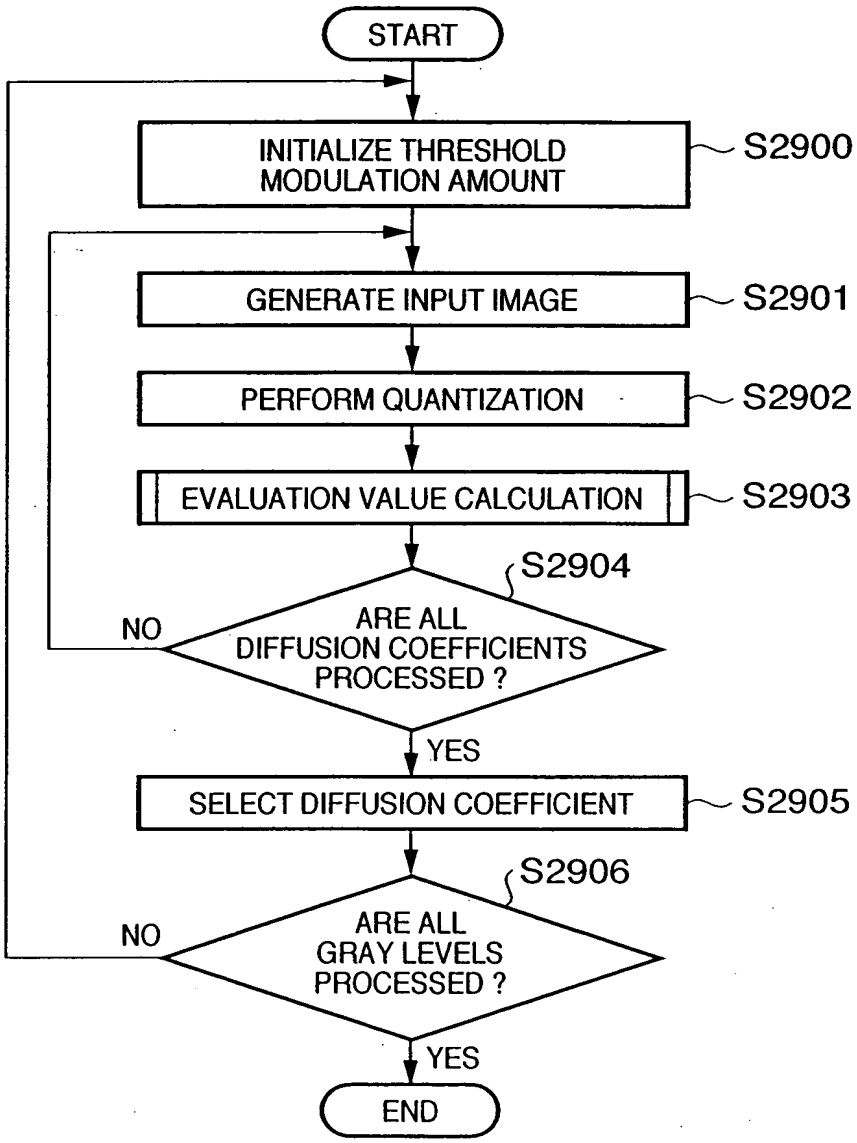

START
INITIALIZE THRESHOLD MODULATION AMOUNT
S2900
GENERATE INPUT IMAGE
S2901
PERFORM QUANTIZATION
S2902
EVALUATION VALUE CALCULATION
S2903
S2904
ARE ALL DIFFUSION COEFFICIENTS PROCESSED ?
NO
YES
SELECT DIFFUSION COEFFICIENT
S2905
S2906
ARE ALL GRAY LEVELS PROCESSED ?
NO
YES
END

FIG. 30

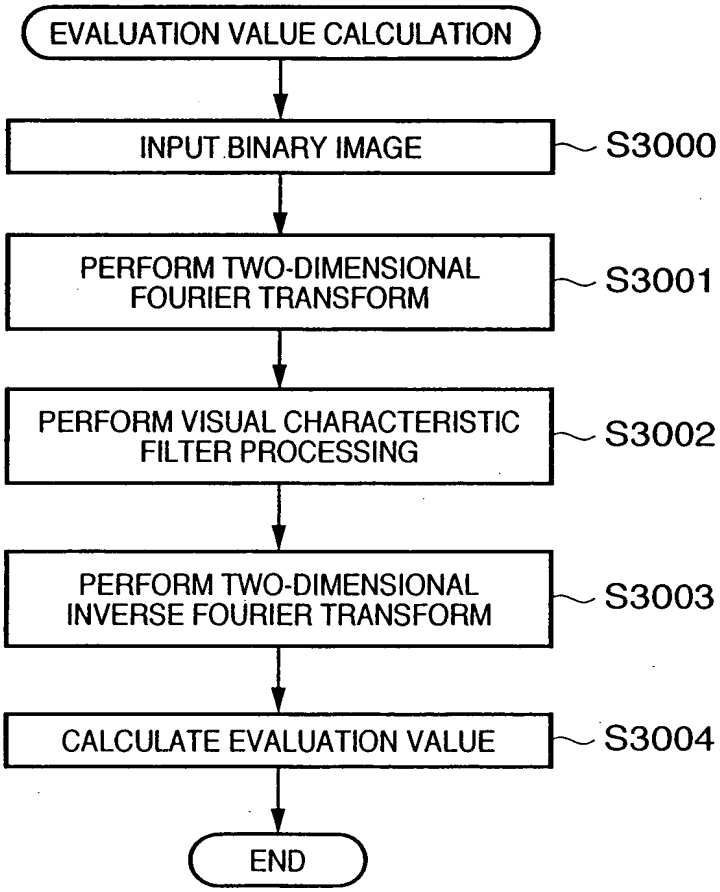

EVALUATION VALUE CALCULATION
INPUT BINARY IMAGE
S3000
PERFORM TWO-DIMENSIONAL FOURIER TRANSFORM
S3001
PERFORM VISUAL CHARACTERISTIC FILTER PROCESSING
S3002
PERFORM TWO-DIMENSIONAL INVERSE FOURIER TRANSFORM
S3003
CALCULATE EVALUATION VALUE
S3004
END

FIG. 31

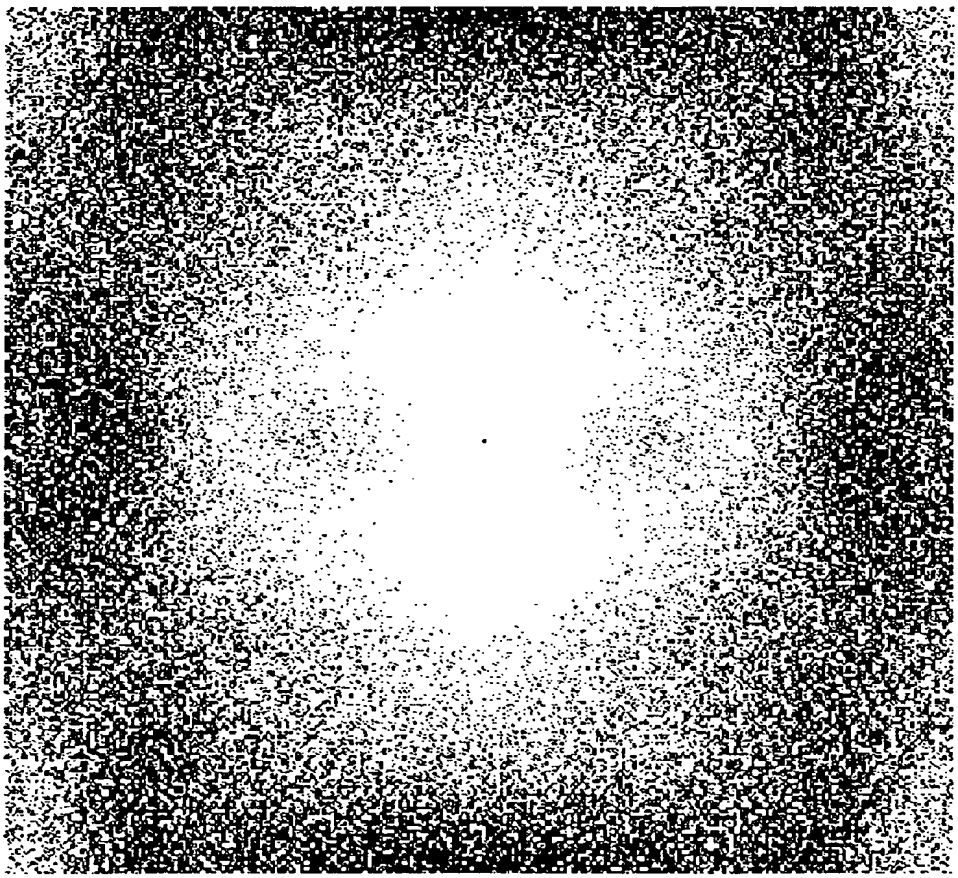


FIG. 32

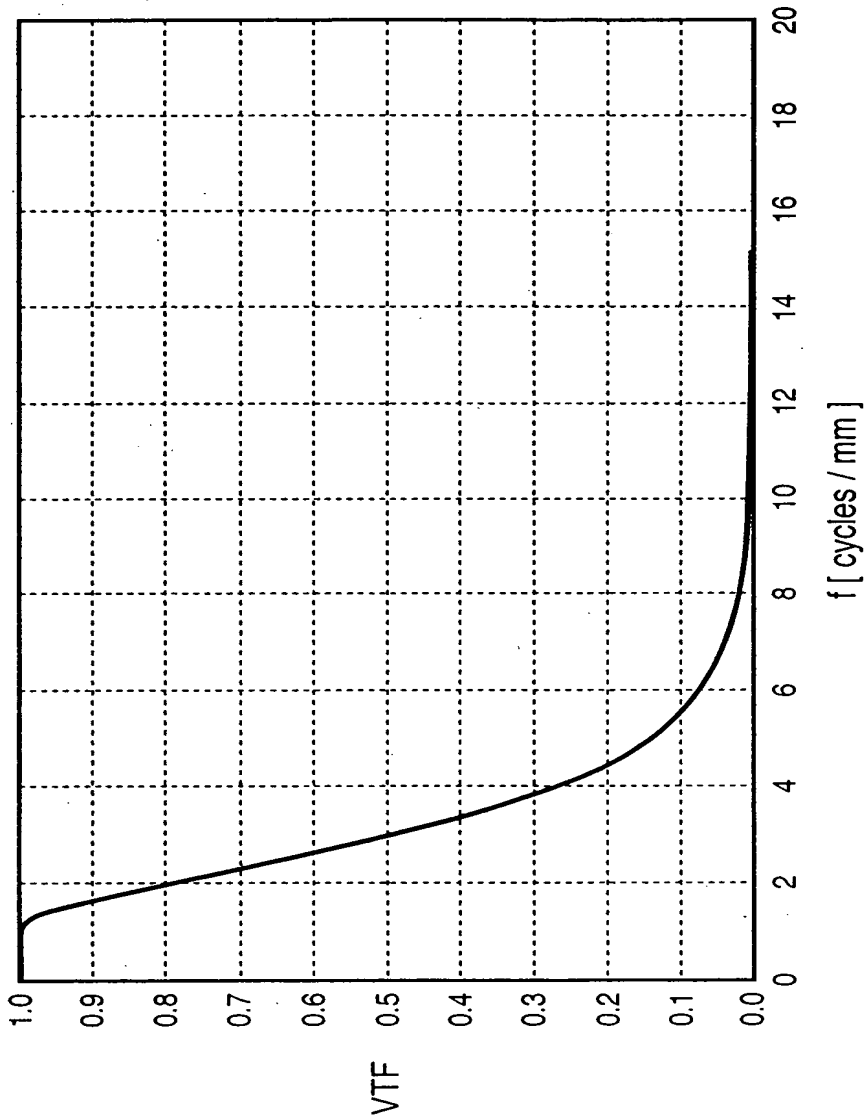

1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
VTF
0
2
4
6
8
10
12
14
16
18
20
f [cycles / mm]

FIG. 33

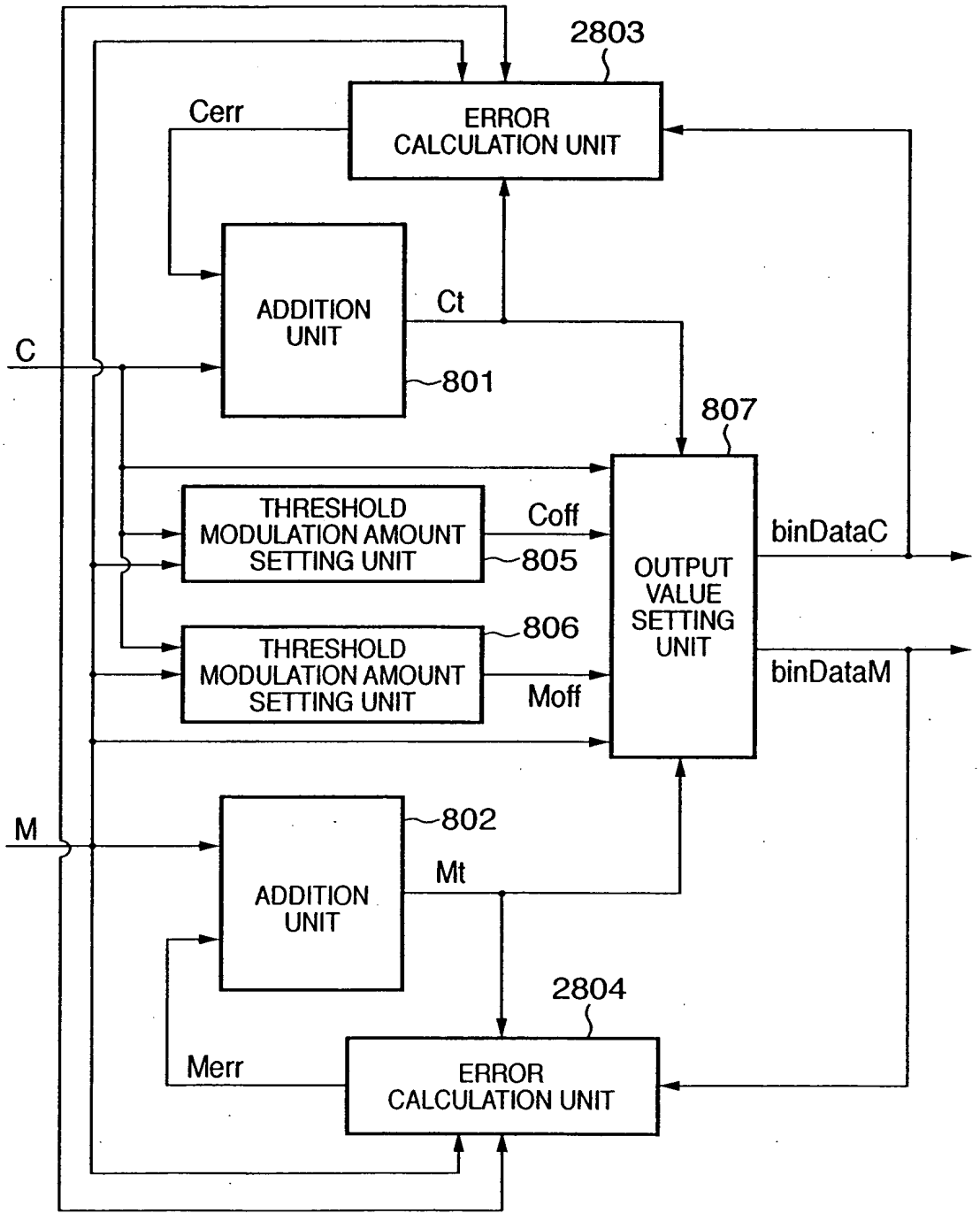
$$\begin{bmatrix} & & * & C0 \\ C1 & C2 & C3 & X \end{bmatrix}$$

$Cm = Sm/Sum \ (m = 1,...4)$

$Sm = 0,1,...,9$

$$Sum = \sum_{m=1}^{4} Sm(\neq 0)$$

FIG. 34


2803
Cerr
ERROR CALCULATION UNIT
ADDITION UNIT
Ct
C
801
807
THRESHOLD MODULATION AMOUNT SETTING UNIT
Coff
805
binDataC
OUTPUT VALUE SETTING UNIT
806
THRESHOLD MODULATION AMOUNT SETTING UNIT
Moff
binDataM
M
802
ADDITION UNIT
Mt
2804
Merr
ERROR CALCULATION UNIT